Probing Plants' Water Needs

Automated time domain reflectrometry system measures soil moisture.

very home gardener can appreciate the desire to put on only enough water—no more, no less—to grow the best tomatoes or the prettiest rose bush on the block. For companies that grow roses or tomatoes for a living, that desire becomes a critical need.

Steven R. Evett and Robert J. Lascano are collaborating to put together a computerized irrigation system that measures and calculates how much water to apply every half hour.

It's a simple concept, Lascano says: "Replace just as much water as the plants have used and you'll get maximum yield with minimum water." He is a soil physicist at Texas A&M University in Lubbock who is working with Evett, other scientists at Texas A&M University, and Dynamax, Inc., of Houston, Texas. Lascano designed the automated system for applying irrigation water.

Evett is a soil physicist at the USDA-ARS Conservation and Production Research Laboratory in Bushland, Texas. He designed the automated time domain reflectometry (TDR) system needed to determine when to irrigate.

The measurement is done with stainless steel probes placed in the ground at varying depths, from a few inches down to several feet.

A computer-controlled TDR instrument sends an electronic pulse through a buried cable to the probes. The longer it takes for the pulse to travel through the probe, the more soil water. The probes work in most irrigated agricultural soils, and one TDR system can handle up to 241 probes, although the cable length is limited to about 100 feet from the instrument.

USDA has signed a cooperative research and development agreement with Dynamax, which is now manufacturing the TDR system.

Evett says the probes are key because they directly measure how much water is left in the soil for plants to use. He also designed the software that controls the TDR system and translates the probe signals into water measurements.

The computer turns the water pumps on and off at pre-determined soil moisture levels, using software written by Lascano.

Evett and Lascano have received inquiries about the system from managers of greenhouses, tree nurseries, orchards, and vineyards.

The fully automated system may be suited only for horticultural use, but other farmers could use the probes manually.

"They can install the probes permanently anywhere they want, with no limit on numbers of probes," says Evett. "They can drive around their fields, stop at each probe and connect the cable tester to each probe for a reading. A laptop computer translates the readings. This is fast and easy. It's sometimes a practical alternative to neutron probes that require a license and special training because of their radioactive content."

Lascano has grown cotton with an automated drip irrigation system for 4 years. He says the tests have been very successful so far and that automation could be used with other crops and other irrigation systems. It could also be used to study the effects of pests and farm practices on crop water use.—By **Don Comis,** ARS.

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Software is available for download on the USDA-ARS Conservation and Production Research Laboratory web site at http://www.cprl.ars.usda. gov/programs

TACQ.EXE - time domain reflectometry system control software. Also look for the system documentation in file TACQ_WPD.ZIP. You will need the PKUNZIP.EXE program to unzip the documentation into Word-Perfect files.

ENWATBAL.EXE - predicts crop water use. Available, along with source code and example data files and documentation, in the self-extracting file ENWATBLZ.EXE

Note: These programs are supplied for information purposes solely. No warranty is intended, nor is any service or support for these programs provided.